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(54) **Preassembled heat exchange unit and vehicle including such unit**

Vormontierte Wärmetauschereinheit und Fahrzeug mit einer solchen Einheit

Unité d'échange de chaleur préassemblée et véhicule automobile comportant une telle unité

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(56) References cited:
EP-A- 0 679 564 DE-A- 3 110 447
US-A- 4 726 326 US-A- 5 580 122

- **PATENT ABSTRACTS OF JAPAN vol. 010, no.**
301 (M-525), 14 October 1986 (1986-10-14) & JP
61 115720 A (YANMAR DIESEL ENGINE CO LTD),
3 June 1986 (1986-06-03)

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Description

[0001] The present invention relates to a heat exchange unit for vehicles and to a motor-vehicle including such heat exchange unit.

[0002] The invention has been developed in view of the application on motor-vehicles of the type comprising a passenger compartment, an engine compartment placed forwardly of the passenger compartment and an internal combustion engine housed in the engine compartment. Vehicles of this type are normally provided with a first heat exchange unit placed forwardly of the engine, in the frontal portion of the vehicle, and with a second heat exchange unit placed between the engine and the passenger compartment. The first heat exchange unit comprises a radiator for cooling the engine, an electric fan associated with the radiator and, for vehicles with air conditioning, a condenser included in the vehicle air conditioning system. The second heat exchange unit comprises a heat exchanger for heating the air flow intended to be sent to the vehicle passenger compartment, a fan unit for producing the air flow directed in the passenger compartment and a cooler in the case of vehicles with air conditioning system.

[0003] Vehicles with a disposition of this type have various drawbacks, a first of which consists in that the components of the heat exchange system placed in the frontal part of the vehicle are subjected to breakage even in case of light front shocks. Furthermore, since in the most recent stylistic solutions the frontal part of the vehicle is constantly lower, the radiators must be lower and wider. Consequently, for creating the space necessary for the headlights it is necessary to increase both the length and the width of the frontal part of the vehicle which projects forwardly of the front axle. The greater dimensions of the frontal part of the vehicle increase the risk of contact with fixed obstacles during manoeuvres. In addition, a greater frontal width of the vehicle does not permit the adoption of an aerodynamic shape, which reduces the aerodynamic drag coefficient (CX). Furthermore, the exhaust manifold of the engine heats the motor of the fan associated with the radiator and it is necessary to leave an empty space between these elements and to introduce a thermal shield. Finally, it is necessary to mount separately two distinct units.

[0004] DE-A-3110447 discloses a motor vehicle comprising an internal combustion engine and at least one heat exchanger arranged close to the passenger compartment of the vehicle. A conduit for the air flow directed into the passenger compartment extends through the heat exchanger.

[0005] The object of the present invention is to provide an improved heat exchange unit which overcomes the above drawbacks and forming an integrated thermic system which can carry out the functions of engine cooling system, air conditioning system and passenger compartment heating system.

[0006] In accordance with the present invention, this

object is achieved by a heat exchange unit having the features forming the subject of the claim 1.

[0007] The present invention will now be disclosed in detail with reference to the attached drawings, given purely by way of non-limiting example, in which:

- figure 1 is a plan schematic view of a vehicle provided with a heat exchange system according to the invention,
- figure 2 is an exploded perspective view of the vehicle of figure 1,
- figure 3 is a schematic cross-section taken along the line III-III of figure 1, and
- figure 4 is a schematic perspective view of the heat exchange unit indicated by the arrow IV-IV in figure 2.

[0008] With reference to the drawings, the numeral reference 10 schematically indicates a vehicle comprising a passenger compartment 12 and an engine compartment 14 placed forwardly of the passenger compartment. An internal combustion engine 16 with the respective gearbox 18 is housed in the engine compartment 14.

[0009] A heat exchange unit 20 in accordance with the present invention is placed between the engine-gearbox assembly 16, 18 and the passenger compartment 12. The heat exchange unit 20 comprises an outer housing 22 of plastics material in which there are housed the components of the engine cooling system, the passenger compartment heating system and possibly of the air conditioning system. In the embodiment shown in the figures, the heat exchange unit 20 has a front section 24 containing a radiator, a condenser, a dehydrating filter and an electric fan assembly 26. In a rear section 28 of the heat exchange unit 20 there are housed a radiator for heating the air flow directed in the passenger compartment, a cooler, an expansion valve and a centrifugal fan for producing the air flow directed in the passenger compartment. The heat exchange unit according to the preferred embodiment of the invention comprises also an air intake 28, a filter 30 for the air flow directed to the passenger compartment and a filter 32 for the air flow fed to the engine. A windscreen wiper device including a motor, a transmission mechanism and a pair of arms 32 mounted on respective oscillating pins 34 can also be mounted on the housing 22. A reservoir for the windshield and possibly headlights washing liquid and the engine air filter can also be mounted on the unit 20 and turn indicators and rear-view mirrors can be mounted on the outer part of the unit 20.

[0010] With reference to figure 2, the vehicle body comprises a metal wall 36 which divides the passenger compartment 12 from the engine compartment 14. The wall 36 is continuous and projects towards the passenger compartment. The heat exchange unit 20 is placed between the wall 36 and the engine-gearbox assembly 16, 18. An aesthetic coating 38 of the dashboard is

mounted on a sheet metal structure 40. The coating 38 carries the traditional openings for distributing the air flow, the instruments and control and adjustment push-buttons and knobs. The sheet metal structure 40 on which there is mounted the aesthetical coating 38 forms a piping for distributing into the passenger compartment 12 the air flow coming from the heat exchange unit 20.

[0011] Referring always to figure 2, a cross-member 42 can be provided for supporting the front portion of the heat exchange unit 20 and, at the same time, for stiffening the vehicle body. An element for dividing the air flow 44 can be arranged in front of the heat exchange unit 20 for conveying towards the radiator part of the air flow coming from the front portion of the vehicle. The element 44 may have a longitudinal wall 46 for dividing in two parts the air flow which enters into the engine compartment. The left side of the air flow (with reference to the direction of movement of the vehicle) is sent to the heat exchange unit 20, whereas the right side of the air flow is directed to the engine, the exhaust manifold and the catalytic exhaust pipe. A transversal wall 48 of the element 44 prevents that the flow of hot air investing the engine 16 reaches the heat exchange unit 20. As shown in figures 2 and 3, the longitudinal wall 46 of the element 44 is preferably arranged so as to rest on the gearbox 18.

[0012] The heat exchange unit 20 forms a completely autonomous preassembled unit comprising electric connections and connecting pipes between various components of the thermic systems and forms an integrated thermic system which carries out the functions of engine cooling system, air conditioning system and passenger compartment heating system. Since the heat exchange unit 20 is placed behind the engine 16, its components are protected by shocks on the frontal part of the vehicle and are not damaged as long as the shock does not produce the movement of the engine.

[0013] Thus, the heat exchange unit according to the invention permits to obtain a reduction of costs for repairing damages caused by frontal shocks. It permits also a reduction of weight, costs and total dimensions of thermic systems of the vehicle. The heat exchange unit also forms a shield which reduces the transmission of noise from the engine towards the passenger compartment of the vehicle.

[0014] The heat exchange unit according to the invention can be designed so that the various components (radiator, condenser, electric fan, etc.) can be removed without having to remove either the engine or the aesthetic coating of the dashboard. The removal of components of thermic systems from the front portion of the vehicle allows the design of vehicles with a lower width of the frontal portion, with a better drag coefficient and gives the designers more freedom for creating new shapes.

[0015] Naturally, while the principle of the invention remains the same, the details of construction and the embodiments may be widely varied with respect to what

has been disclosed and illustrated without thereby departing from the scope of the present invention as defined by the claims.

Claims

1. Heat exchange unit for vehicles, comprising an outer housing (22) of plastic material intended to be mounted between the engine (16) and the passenger compartment (12) of a vehicle, the components of the cooling system of the vehicle internal combustion engine and the components of a system for treating an air flow directed to the passenger compartment of the vehicle being housed into said outer housing (22), the outer housing (22) and said components forming an autonomous preassembled unit comprising electric connections and connecting pipes between said components.
2. Heat exchange unit according to claim 1, characterized in that it comprises the components of a heating system and the components of an air conditioning system of the vehicle.
3. Heat exchange unit according to claim 1 or 2, characterized in that it comprises also the components of a windscreen wiper assembly of the vehicle.
4. Heat exchange unit according to claim 1 or 2, characterized in that it comprises also an air filter of the internal combustion engine.
5. Heat exchange unit according to claim 1 or 2, characterized in that it comprises also a support for the vehicle headlights.
6. Heat exchange unit according to claim 1 or 2, characterized in that it comprises also a support for the outer rear-view mirrors.
7. Heat exchange unit according to claim 1 or 2, characterized in that it comprises also a support for lateral turn indicators.
8. Heat exchange unit according to claim 1, characterized in that it comprises an element (44) for dividing the air flow coming from the frontal part of wall (46) which divides in two parallel parts the air flow entering in the engine compartment (12) of the vehicle.

Patentansprüche

1. Wärmetauschereinheit für Fahrzeuge, mit einem Außengehäuse (22) aus Kunststoffmaterial zur Montag zwischen dem Motor (16) und der Fahr-

- gastzelle (12) eines Fahrzeugs, wobei die Bauteile des Kühlsystems des Fahrzeugmotors mit innerer Verbrennung und die Bauteile eines Systems zur Behandlung eines zur Fahrgastzelle des Fahrzeugs gerichteten Luftstroms in dem Außengehäuse (22) untergebracht sind und das Außengehäuse (22) mit diesen Bauteilen eine autonome vormontierte Einheit mit elektrischen Verbindungen und Verbindungsrohren zwischen den Bauteilen bildet.
2. Wärmetauschereinheit gemäß Anspruch 1, **dadurch gekennzeichnet, dass** sie die Bauteile eines Heizsystems und die Bauteile einer Klimaanlage des Fahrzeugs umfasst.
 3. Wärmetauschereinheit gemäß Anspruch 1 oder 2, **dadurch gekennzeichnet, dass** sie auch die Bauteile einer Scheibenwischeranordnung des Fahrzeugs umfasst.
 4. Wärmetauschereinheit gemäß Anspruch 1 oder 2, **dadurch gekennzeichnet, dass** sie auch einen Luftfilter des Verbrennungsmotors umfasst.
 5. Wärmetauschereinheit gemäß Anspruch 1 oder 2, **dadurch gekennzeichnet, dass** sie auch eine Halterung für die Fahrzeug-Scheinwerfer umfasst.
 6. Wärmetauschereinheit gemäß Anspruch 1 oder 2, **dadurch gekennzeichnet, dass** sie auch eine Halterung für die Außenrückspiegel umfasst.
 7. Wärmetauschereinheit gemäß Anspruch 1 oder 2, **dadurch gekennzeichnet, dass** sie auch eine Halterung für die Seitenblinker umfasst.
 8. Wärmetauschereinheit gemäß Anspruch 1, **dadurch gekennzeichnet, dass** sie ein Element (44) zum Teilen des Luftstroms umfasst, der vom vorderen Teil der Wand (46) kommt, die den in den Motorraum (14) des Fahrzeugs eintretenden Luftstrom in zwei parallele Teile teilt.
- tubes de raccordement entre les éléments.
2. Unité d'échange de chaleur selon la revendication 1, **caractérisée en ce qu'elle** comprend les éléments constitutifs d'un circuit de chauffage et les éléments constitutifs d'un circuit de conditionnement d'air du véhicule.
 3. Unité d'échange de chaleur selon la revendication 1 ou 2, **caractérisée en ce qu'elle** comprend aussi les éléments constitutifs d'un élément essuie-glace de pare-brise du véhicule.
 4. Unité d'échange de chaleur selon la revendication 1 ou 2, **caractérisée en ce qu'elle** comprend en outre un filtre à air du moteur à combustion interne.
 5. Unité d'échange de chaleur selon la revendication 1 ou 2, **caractérisée en ce qu'elle** comprend en outre un support des phares du véhicule.
 6. Unité d'échange de chaleur selon la revendication 1 ou 2, **caractérisée en ce qu'elle** comporte en outre un support des rétroviseurs extérieurs.
 7. Unité d'échange de chaleur selon la revendication 1 ou 2, **caractérisée en ce qu'elle** comporte aussi un support des indicateurs latéraux de changement de direction.
 8. Unité d'échange de chaleur selon la revendication 1, **caractérisée en ce qu'elle** comprend un élément (44) de séparation du courant d'air provenant de la partie frontale de la paroi (46) qui divise en deux parties parallèles le courant d'air entrant dans le compartiment (12) du moteur du véhicule.

Revendications

1. Unité d'échange de chaleur destinée à des véhicules, comprenant un boîtier externe (22) de matière plastique destiné à être monté entre le moteur (16) et le compartiment des passagers (12) d'un véhicule, les éléments constitutifs du circuit de refroidissement du moteur à combustion interne du véhicule et les éléments d'un circuit de traitement d'un courant d'air dirigé vers le compartiment des passagers du véhicule étant logés dans le boîtier externe (22), le boîtier externe (22) et les éléments constitutifs formant une unité autonome préalablement assemblée comprenant des connexions électriques et des



